CLAIMS

What is claimed is:

1. A method of determining value-at-risk, comprising the steps of:

electronically receiving financial market transaction data over an electronic network;

electronically storing in a computer-readable medium said received financial market transaction data;

constructing an inhomogeneous time series z that represents said received financial market transaction data;

constructing an exponential moving average operator;

constructing an iterated exponential moving average operator based on said exponential moving average operator;

constructing a time-translation-invariant, causal operator $\Omega[z]$ that is a convolution operator with kernel ω and that is based on said iterated exponential moving average operator;

electronically calculating values of one or more predictive factors relating to said time series z, wherein said one or more predictive factors are defined in terms of said operator $\Omega[z]$;

electronically storing in a computer readable medium said calculated values of one or more predictive factors; and

electronically calculating value-at-risk from said calculated values.

2. The method of claim 1, wherein said operator $\Omega[z]$ has the form:

$$\begin{aligned}\Omega[z](t) &= \int_{-\infty}^{t} dt'\omega(t-t')\, z(t') \\ &= \int_{0}^{\infty} dt'\omega(t')\, z(t-t').\end{aligned}$$

3. The method of claim 1, wherein said exponential moving average operator $\mathrm{EMA}[\tau\, ;\, z]$ has the form:

$$\mathrm{EMA}[\tau;z](t_n) = \mu\ \mathrm{EMA}(\tau;z](t_{n-1}) + (\nu-\mu)\ z_{n-1} + (1-\nu)\, z_n \text{, with}$$

$$\alpha = \frac{\tau}{t_n - t_{n-1}}, \tag{23}$$

$$\mu = e^{-\alpha},$$

where v depends on a chosen interpolation scheme.

4. The method of claim 1, wherein said operator $\Omega[z]$ is a differential operator $\Delta[\tau]$ that has the form:

$$\Delta[\tau] = \gamma(\mathrm{EMA}[\alpha\tau, 1] + \mathrm{EMA}[\alpha\tau, 2] - 2\ \mathrm{EMA}[\alpha\beta\tau, 4]),$$

where γ is fixed so that the integral of the kernel of the differential operator from the origin to the first zero is 1; α is fixed by a normalization condition that requires $\Delta[\tau; c] = 0$ for a constant c; and β is chosen in order to get a short tail for the kernel of the differential operator $\Delta[\tau]$.

5. The method of claim 4 wherein said one or more predictive factors comprises a return of the form $r[\tau] = \Delta[\tau; x]$, where x represents a logarithmic price.

6. The method of claim 1 wherein said one or more predictive factors comprises a momentum of the form $x - \mathrm{EMA}[\tau\ ; x]$, where x represents a logarithmic price.

7. The method of claim 1 wherein said one or more predictive factors comprises a volatility.

8. The method of claim 7 wherein said volatility is of the form:

$$\mathrm{Volatility}\,[\tau, \tau', p; z] = \mathrm{MNorm}\ [\tau/2, p; \Delta[\tau'; z]],$$ where

$$\mathrm{MNorm}[\tau, p; z] = \mathrm{MA}[\tau; |z|^{p}]^{1/p},$$ and

$$\mathrm{MA}[\tau,n] = \frac{1}{n}\sum_{k=1}^{n} \mathrm{EMA}[\tau', k], \qquad \text{with } \tau' = \frac{2\tau}{n+1},$$ and where p satisfies $0 < p \leq 2$, and τ' is a time horizon of a return $r[\tau] = \Delta[\tau; \mathrm{x}]$, where x represents a logarithmic price.